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(54) **METHOD AND APPARATUS FOR CREATING A SECURE ANYWHERE SYSTEM**

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(58) **Field of Classification Search**
USPC 726/26, 22, 23, 24, 25; 711/163, 164
See application file for complete search history.

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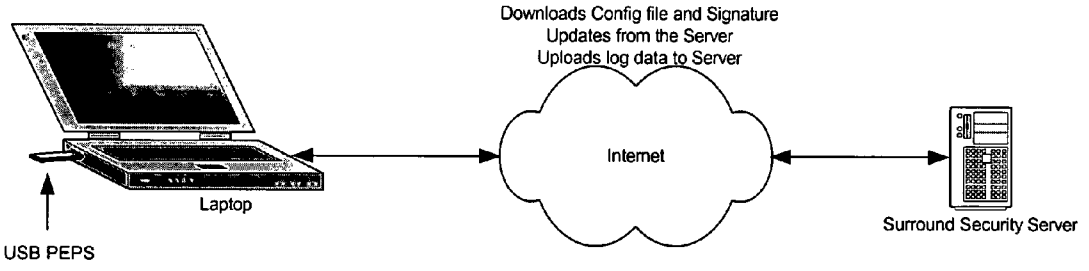
(57) **ABSTRACT**

A method and apparatus for providing portable end-point security are provided. In one embodiment, a PEPS system may include a PEPS processor having a memory operatively coupled thereto, the memory having stored therein instructions which when executed by the PEPS processor causes: an automatic loader to automatically trigger loading of the PEPS system; the PEPS system including a malicious software detector to scan a main memory of the computing system for malicious software; and wherein the malicious software detector performs a scan of the main memory of the computing system following triggering of the PEPS system by the automatic loader by comparing existing data in main memory of the computing system with indicia of malicious software.

24 Claims, 15 Drawing Sheets



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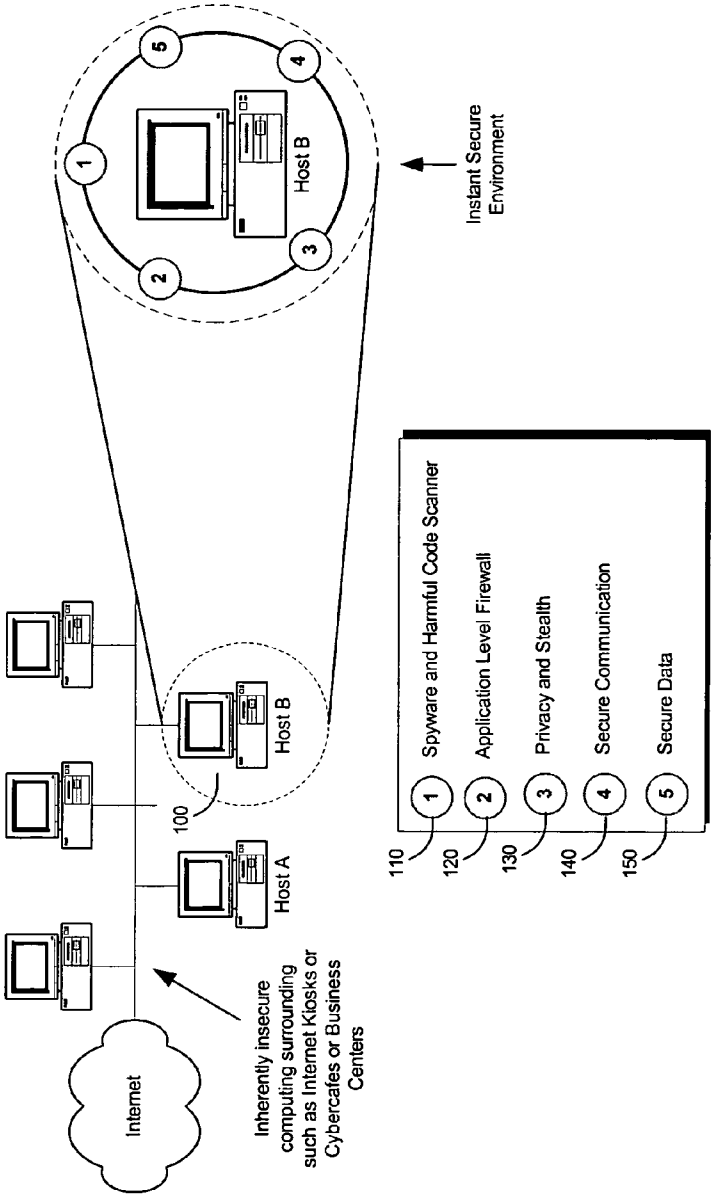
Internet
Inherently insecure computing surrounding such as Internet Kiosks or Cybercafes or Business Centers
Host A
Host B
100
Host B
Instant Secure Environment
1
2
3
4
5
Spyware and Harmful Code Scanner
Application Level Firewall
Privacy and Stealth
Secure Communication
Secure Data
110
120
130
140
150

Fig. 1A

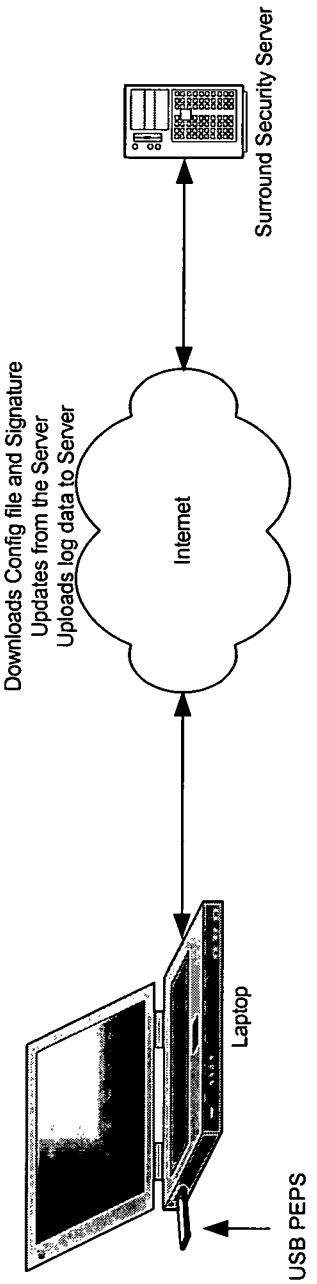
Surround Security Server
Downloads Config file and Signature
Updates from the Server
Uploads log data to Server
Internet
Laptop
USB PEPS

Fig. 1B

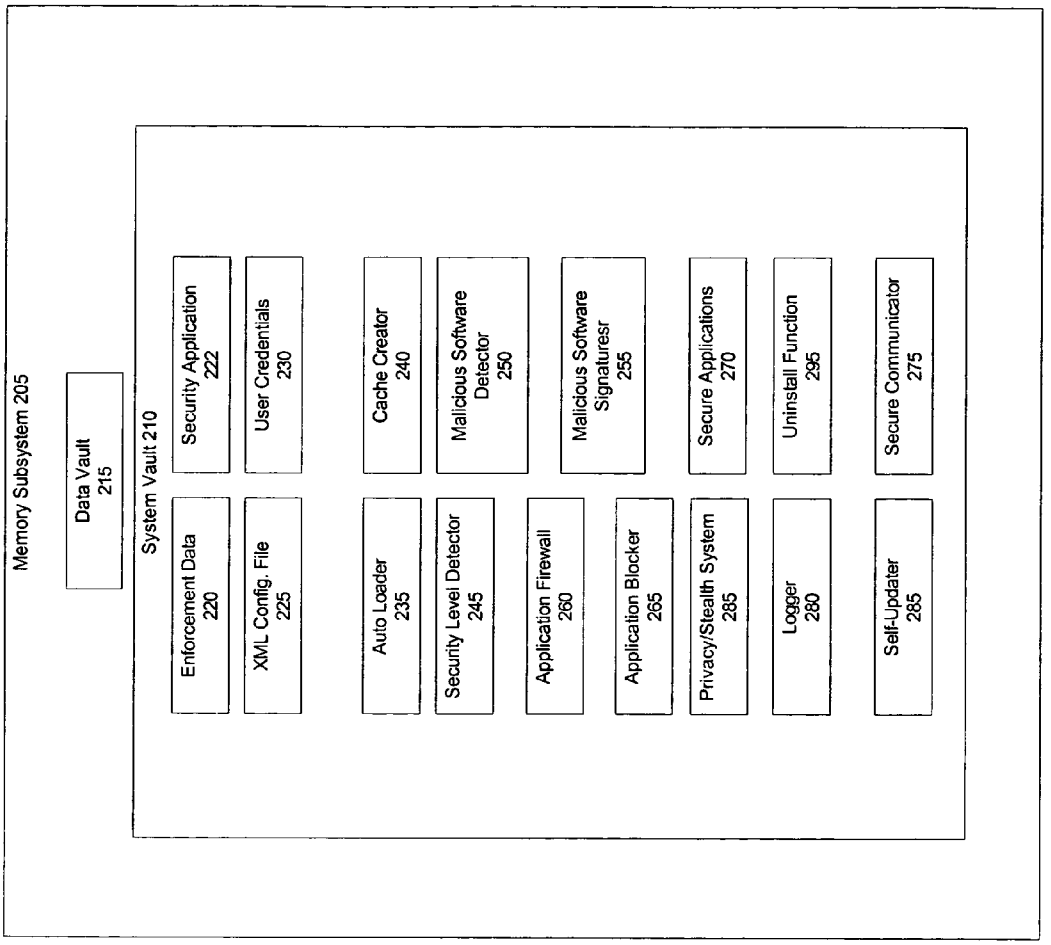
Memory Subsystem 205
Data Vault 215
System Vault 210
Enforcement Data 220
Security Application 222
XML Config. File 225
User Credentials 230
Auto Loader 235
Cache Creator 240
Security Level Detector 245
Malicious Software Detector 250
Application Firewall 260
Malicious Software Signaturesr 255
Application Blocker 265
Secure Applications 270
Privacy/Stealth System 285
Uninstall Function 295
Logger 280
Secure Communicator 275
Self-Updater 285

Fig. 2

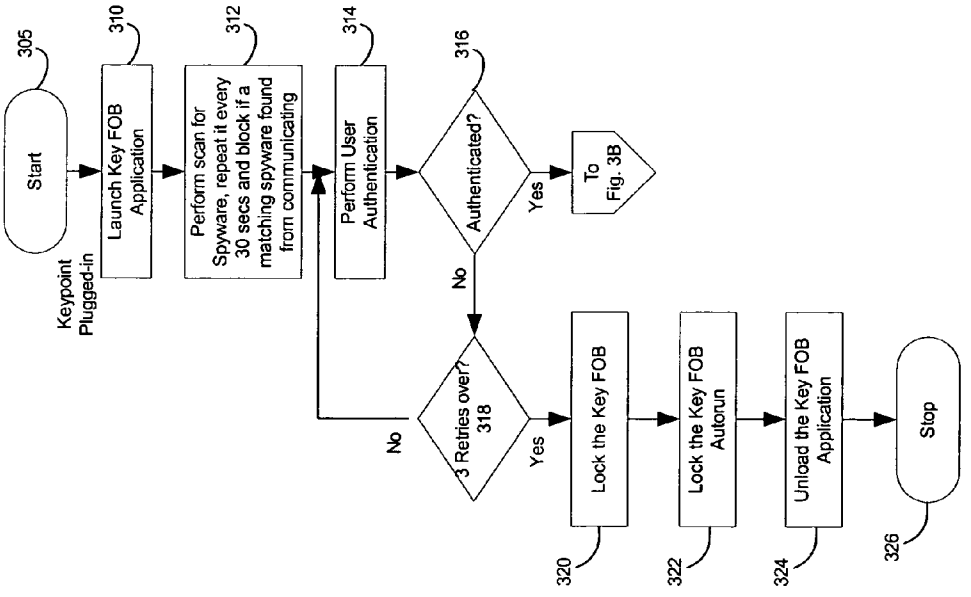
Start
305
Keypoint Plugged-in
Launch Key FOB Application
310
Perform scan for Spyware, repeat it every 30 secs and block if a matching spyware found from communicating
312
Perform User Authentication
314
Authenticated?
316
Yes
To Fig. 3B
No
3 Retries over?
318
No
Yes
Lock the Key FOB
320
Lock the Key FOB Autorun
322
Unload the Key FOB Application
324
Stop
326

Fig. 3A

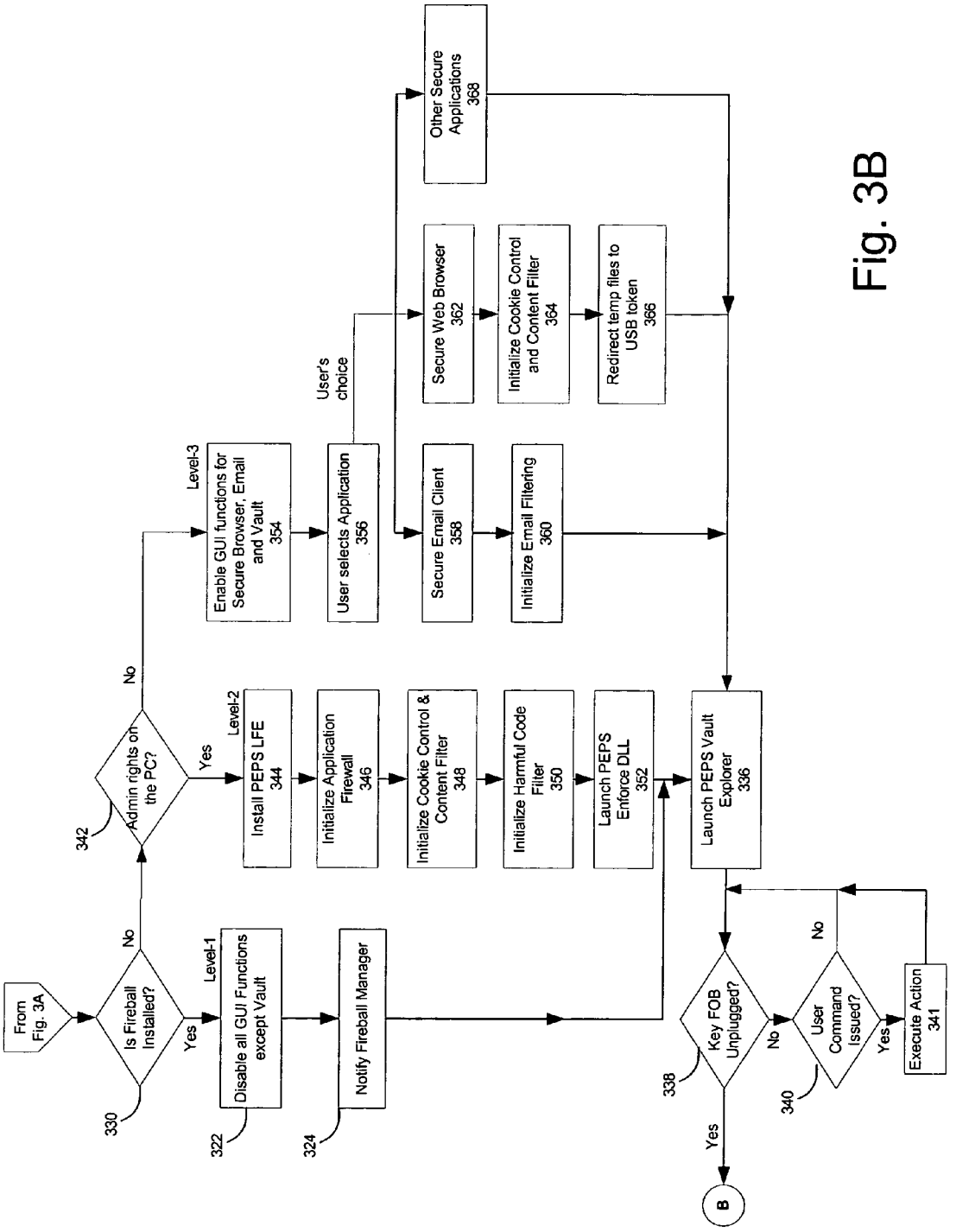
From Fig. 3A
Is Fireball Installed?
330
No
Yes
Level-1
Disable all GUI Functions except Vault
322
Notify Fireball Manager
324
Admin rights on the PC?
342
No
Yes
Level-2
Install PEPS LFE 344
Initialize Application Firewall 346
Initialize Cookie Control & Content Filter 348
Initialize Harmful Code Filter 350
Launch PEPS Enforce DLL 352
Level-3
Enable GUI functions for Secure Browser, Email and Vault 354
User selects Application 356
User's choice
Secure Email Client 358
Initialize Email Filtering 360
Secure Web Browser 362
Initialize Cookie Control and Content Filter 364
Redirect temp files to USB token 366
Other Secure Applications 368
Launch PEPS Vault Explorer 336
Key FOB Unplugged?
338
No
Yes
B
User Command Issued?
340
No
Yes
Execute Action 341

Fig. 3B

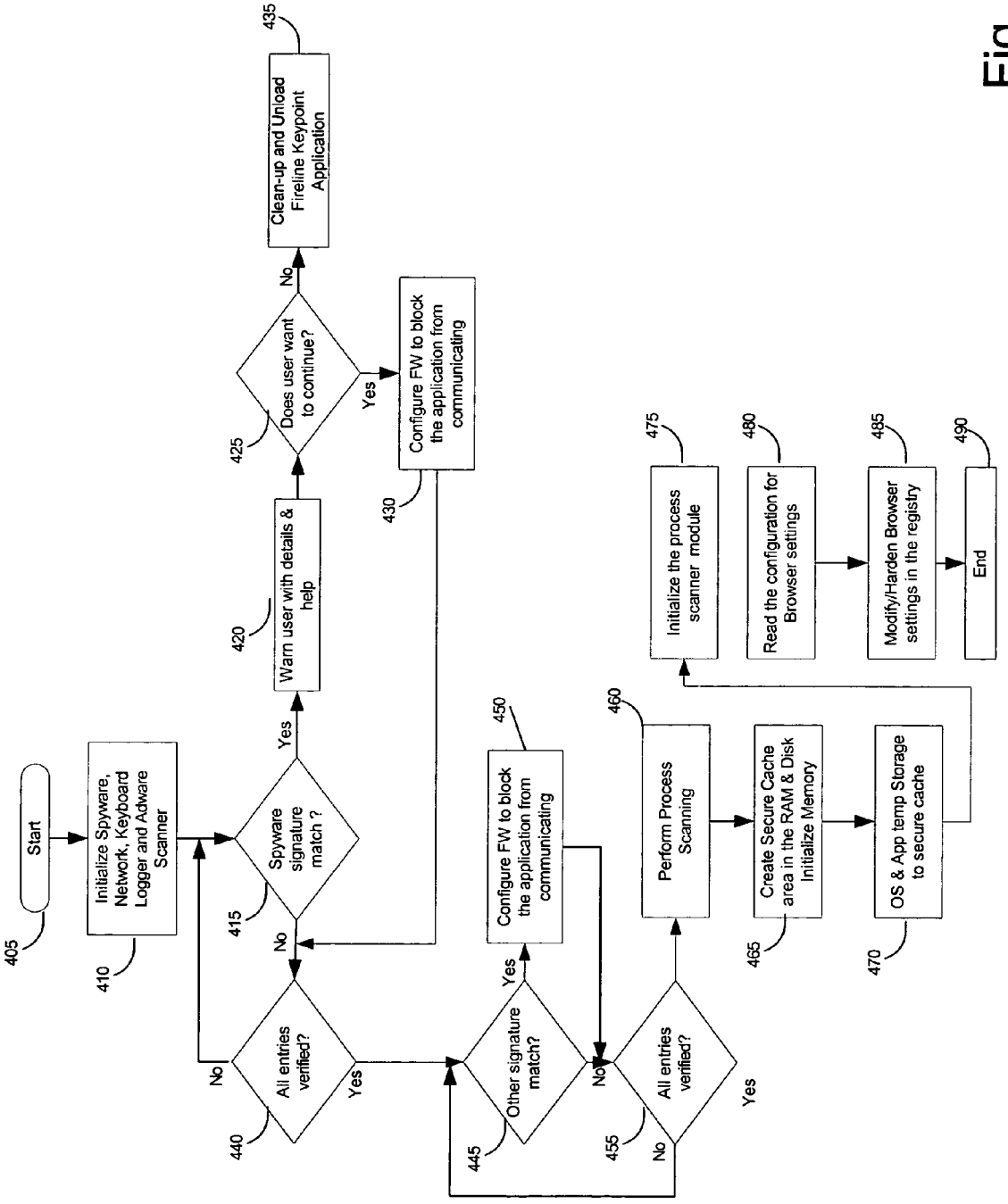
Start
405
Initialize Spyware, Network, Keyboard Logger and Adware Scanner
410
Spyware signature match ?
415
Yes
No
Warn user with details & help
420
Does user want to continue?
425
Yes
No
Configure FW to block the application from communicating
430
Clean-up and Unload Fireline Keypoint Application
435
All entries verified?
440
No
Yes
Other signature match?
445
Yes
No
Configure FW to block the application from communicating
450
All entries verified?
455
No
Yes
Perform Process Scanning
460
Create Secure Cache area in the RAM & Disk Initialize Memory
465
OS & App temp Storage to secure cache
470
Initialize the process scanner module
475
Read the configuration for Browser settings
480
Modify/Harden Browser settings in the registry
485
End
490

Fig. 4

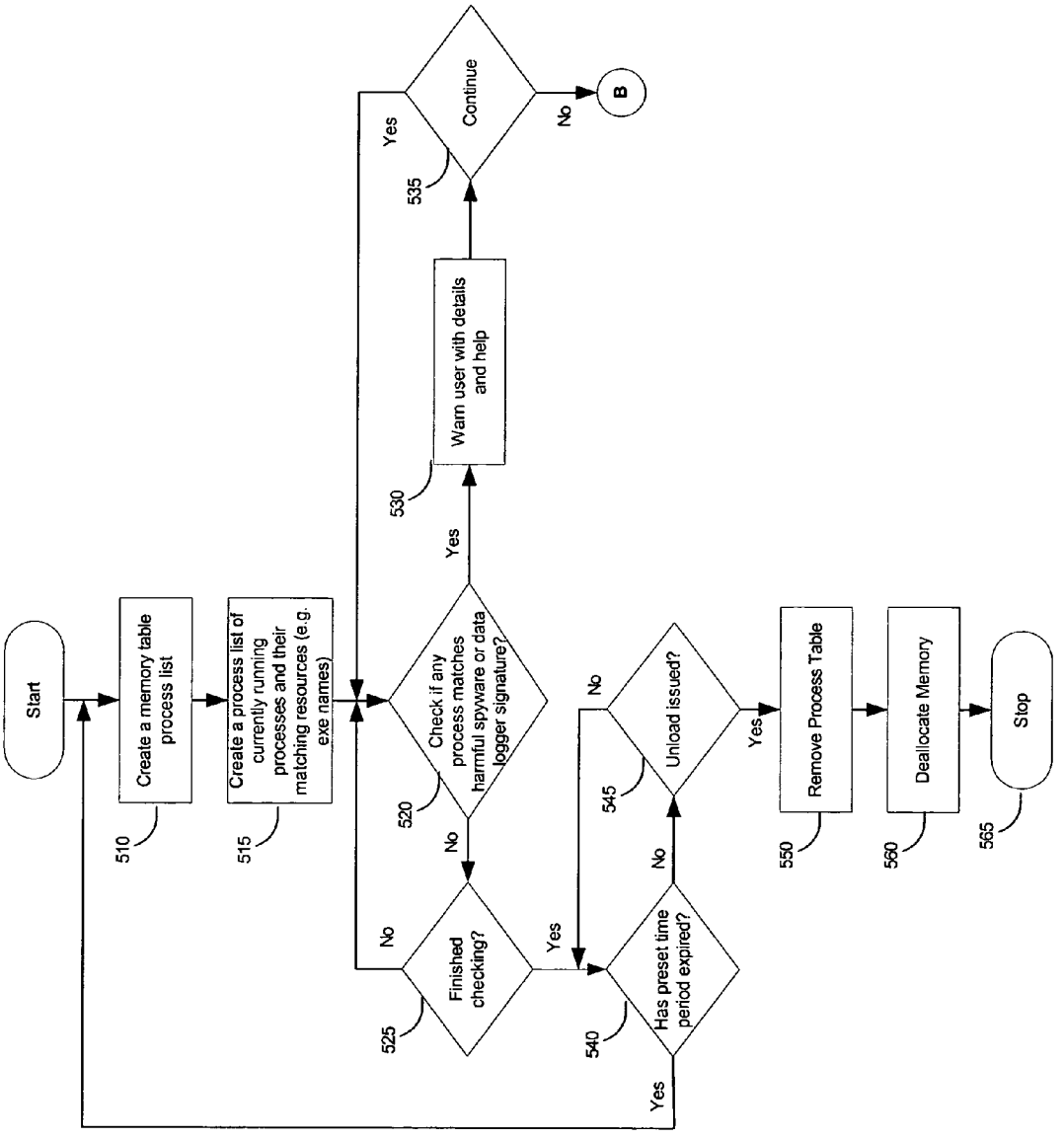
Start
Create a memory table process list
510
Create a process list of currently running processes and their matching resources (e.g. exe names)
515
Check if any process matches harmful spyware or data logger signature?
520
Yes
Warn user with details and help
530
Continue
535
Yes
No
B
No
Finished checking?
525
No
Yes
Has preset time period expired?
540
No
Yes
Unload issued?
545
No
Yes
Remove Process Table
550
Deallocate Memory
560
Stop
565

Fig. 5

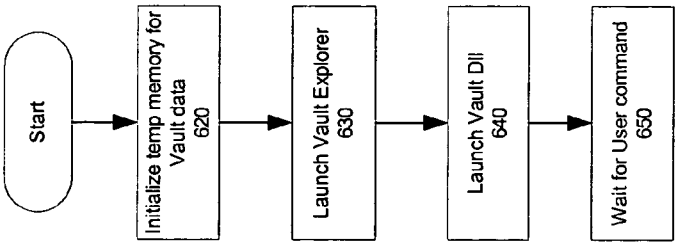
Start
Initialize temp memory for Vault data 620
Launch Vault Explorer 630
Launch Vault Dll 640
Wait for User command 650

Fig. 6

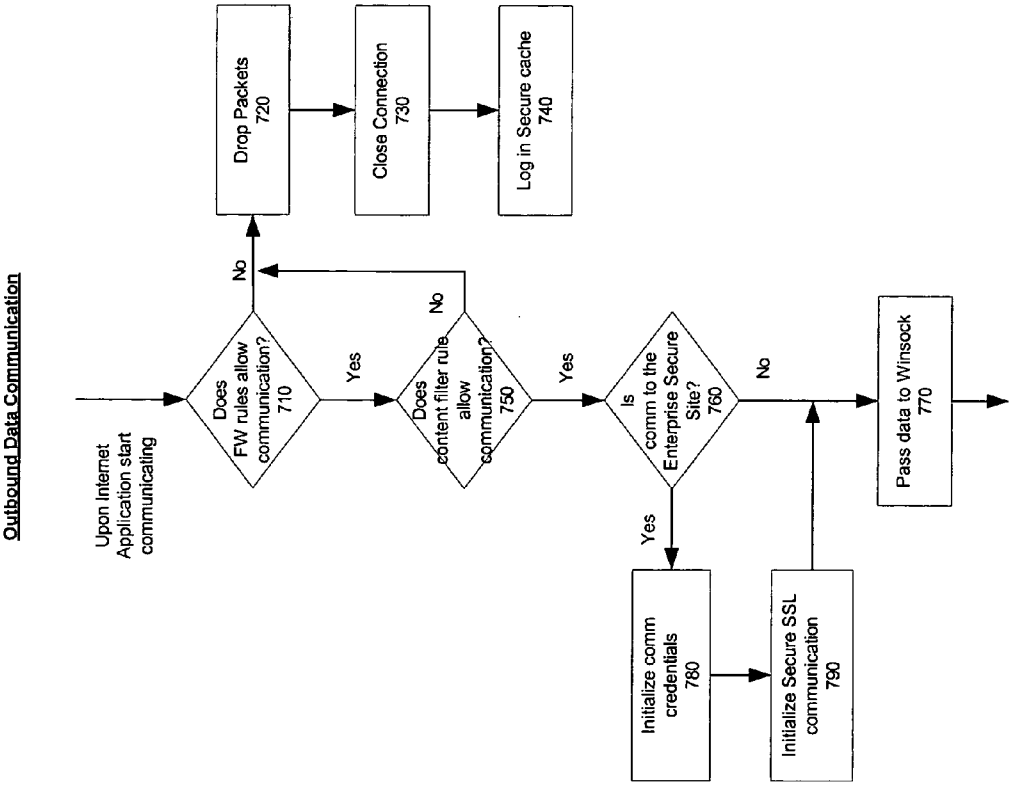
Outbound Data Communication
Upon Internet Application start communicating
Does FW rules allow communication? 710
No
Yes
Drop Packets 720
Close Connection 730
Log in Secure cache 740
Does content filter rule allow communication? 750
No
Yes
Is comm to the Enterprise Secure Site? 760
No
Yes
Initialize comm credentials 780
Initialize Secure SSL communication 790
Pass data to Winsock 770

Fig. 7

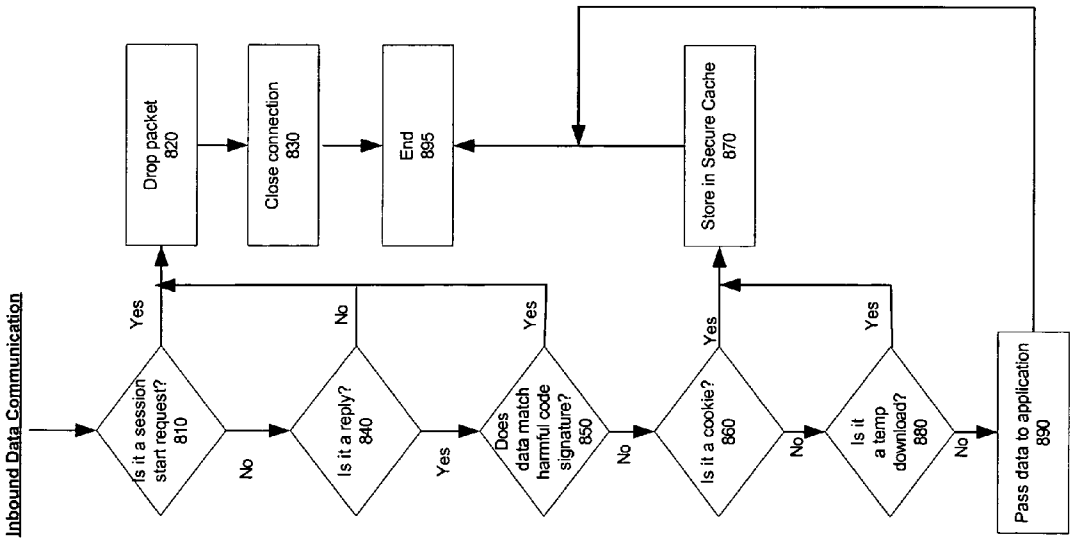
Inbound Data Communication
Is it a session start request? 810
Yes
No
Is it a reply? 840
No
Yes
Does data match harmful code signature? 850
Yes
No
Is it a cookie? 860
Yes
No
Is it a temp download? 880
Yes
No
Drop packet 820
Close connection 830
End 895
Store in Secure Cache 870
Pass data to application 890

Fig. 8

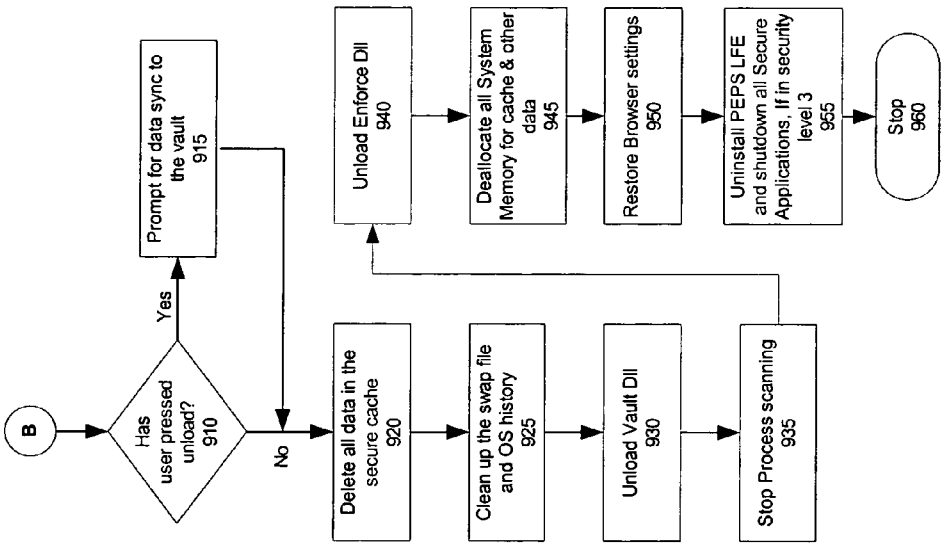
B
Has user pressed unload? 910
Yes
No
Prompt for data sync to the vault 915
Delete all data in the secure cache 920
Clean up the swap file and OS history 925
Unload Vault Dll 930
Stop Process scanning 935
Unload Enforce Dll 940
Deallocate all System Memory for cache & other data 945
Restore Browser settings 950
Uninstall PEPS LFE and shutdown all Secure Applications, If in security level 3 955
Stop 960

Fig. 9

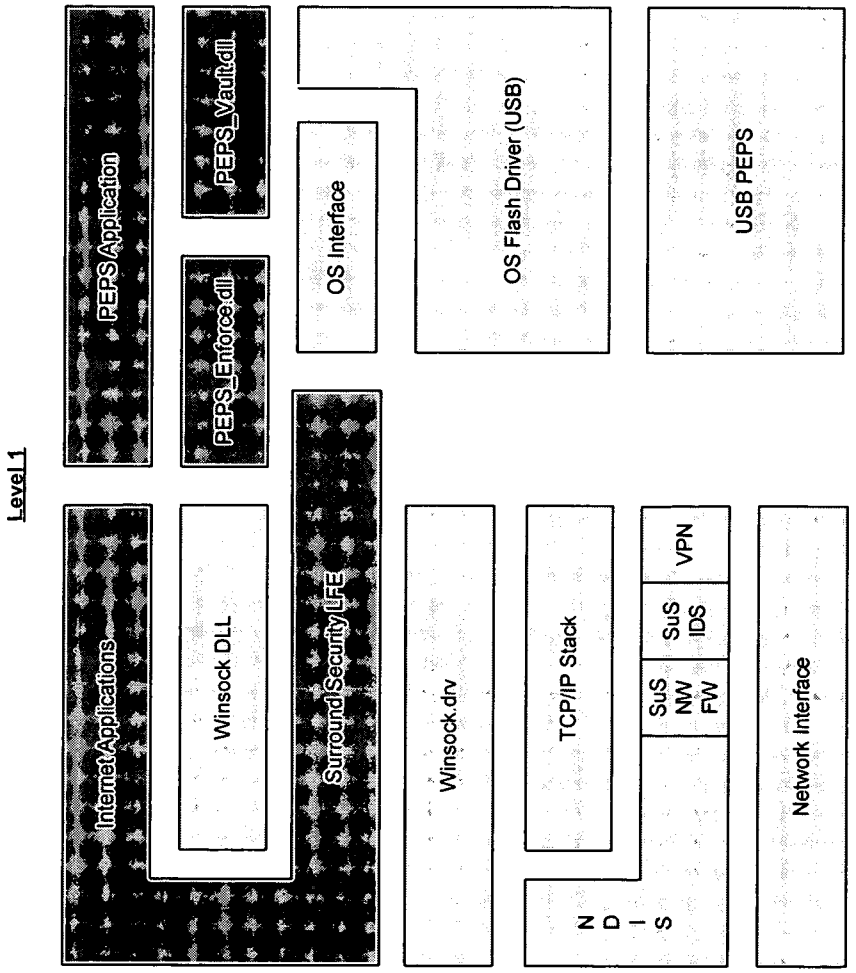
Level 1
Internet Applications
Winsock DLL
Surround Security LFE
PEPS Application
PEPS_Enforce.dll
PEPS_Vault.dll
OS Interface
OS Flash Driver (USB)
USB PEPS
Winsock.drv
TCP/IP Stack
NDIS
SuS NW FW
SuS IDS
VPN
Network Interface

Fig. 10A

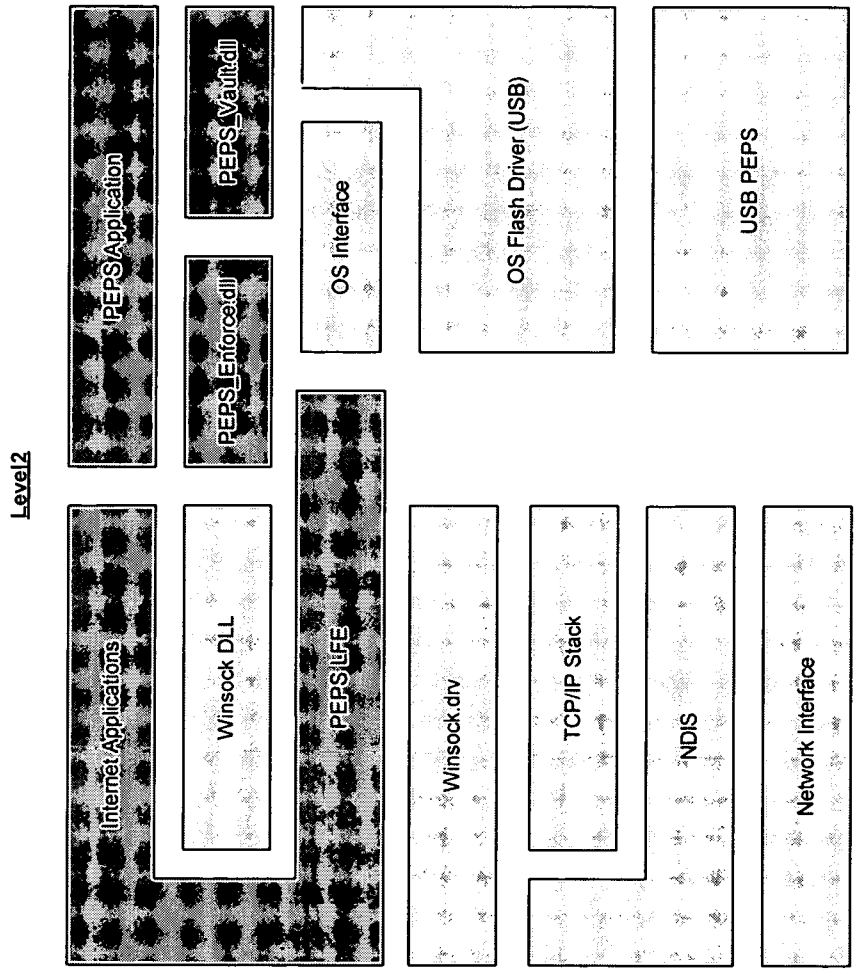
Level2
Internet Applications
Winsock DLL
PEPS_LIFE
PEPS Application
PEPS_Enforce.dll
PEPS_Vault.dll
OS Interface
OS Flash Driver (USB)
USB PEPS
Winsock.drv
TCP/IP Stack
NDIS
Network Interface

Fig. 10B

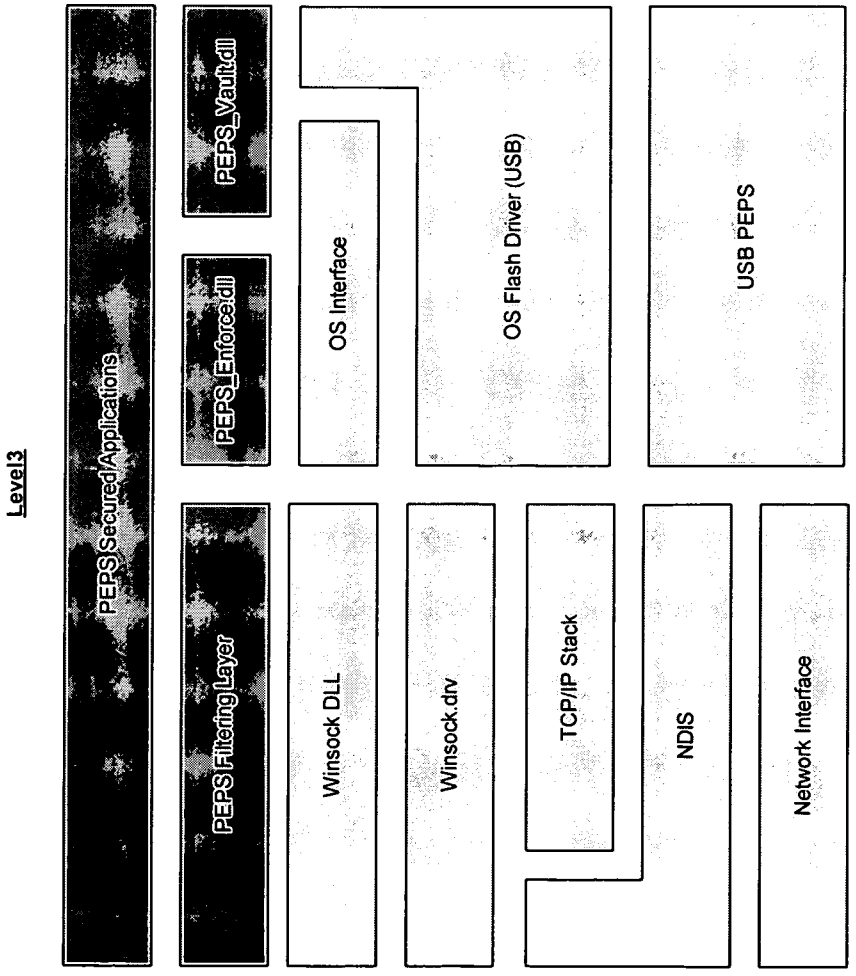
Level3
PEPS Secured Applications
PEPS Filtering Layer
PEPS_Enforce.dll
PEPS_Vault.dll
Winsock DLL
Winsock.drv
TCP/IP Stack
NDIS
Network Interface
OS Interface
OS Flash Driver (USB)
USB PEPS

Fig. 10C

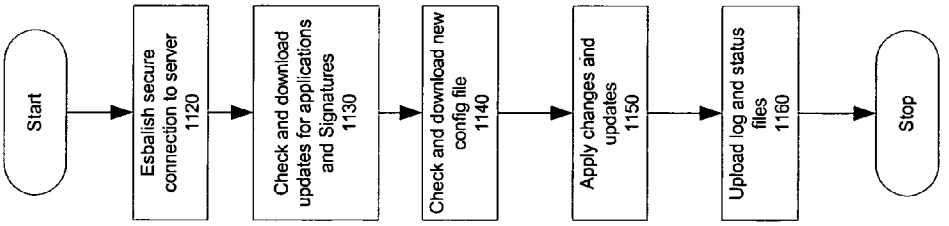
Start
Esbalish secure connection to server 1120
Check and download updates for applications and Signatures 1130
Check and download new config file 1140
Apply changes and updates 1150
Upload log and status files 1160
Stop

Fig. 11

METHOD AND APPARATUS FOR CREATING A SECURE ANYWHERE SYSTEM

FIELD OF THE INVENTION

The present invention relates to computer security, and more particularly to securing a computer in an insecure environment.

BACKGROUND

As the Internet became prevalent and accessible from almost anywhere, the choice of connectivity to the Internet grew as well. Corporate boundaries expanded beyond the physical campus network, Roaming employees could connect to the corporate network from almost anywhere using a Virtual Private Network (VPN). An employee could be on his desktop in the office; at home on his home machine; at an airport, a cybercafe, or a hotel room with his laptop; or at a Kiosk computer and he/she could still connect to the corporate network and access emails as well as other useful data.

This extremely powerful connectivity is extremely dangerous. Being able to access emails and corporate data from a Kiosk or a cybercafe is very useful and convenient, however, it has risks. The computer being used is not under the control of the user at all times. The computer or kiosk could monitor the data that comes through. It could include various types of spyware, which logs keystrokes, or interactions. This makes anything and everything an employee does on the network vulnerable to be captured regardless of whether or not VPN is used. Even if the computer is the user's own laptop, if the access point has spyware on it, what the employee does could still be compromised. Furthermore, using the captured data, the entire corporate network may become vulnerable. Even without an active spyware application, by showing what sites a user visited (history) and what cookies were activated, significant amounts of information can be obtained.

Security threats at the end-point computers have been a key issue for many enterprises and computer users. However with the network boundaries disappearing, the threat of inadvertent exposure of the corporate data is greater than ever before. Therefore, a better way of securing data in an environment where the computer or the network is not under the user's control at all times would be advantageous.

SUMMARY OF THE INVENTION

A method and apparatus for portable end-point security.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which like reference numerals refer to similar elements and in which:

FIG. **1**A is a block diagram of a network including a computer system on which a portable end-point security (PEPS) may be used.

FIG. **1**B is a diagram of the interaction of the computing system including PEPS and a server.

FIG. **2** is a block diagram of the software components of the PEPS **200**.

FIGS. **3**A and **3**B are a flowchart of one embodiment of using the PEPS system.

FIG. **4** is a flowchart of one embodiment of the spyware scanning engine.

FIG. **5** is a flowchart of one embodiment of the process-scanning portion of the spyware scanning engine.

FIG. **6** is a flowchart of one embodiment of installing the vault on the PEPS.

FIG. **7** is a flowchart of one embodiment of outbound data communication processing.

FIG. **8** is a flowchart of one embodiment of inbound data communication processing.

FIG. **9** is a flowchart of one embodiment of the unload process.

FIGS. **10**A-C are block diagrams illustrating where the protection takes place in the OS and communication stack.

FIG. **11** is a flowchart of one embodiment of interaction between the PEPS and a server.

DETAILED DESCRIPTION

A method and apparatus for creating a secure working environment on a potentially insecure computer is described. The present invention is a portable end-point security (PEPS) device that includes software to establish a secure perimeter. Upon connecting the PEPS to a computer, in one embodiment, the software automatically installs itself on that end-point computer, and creates a secure environment for the user. In one embodiment, the PEPS creates a secure cache within that computer for all temporary user data and facilitates secure authentication and communication with a server, or remote system. In one embodiment, PEPS is implemented in a USB (universal serial bus) key. Alternatively, PEPS may be implemented as an Attachable Hard Drive, PCMCIA (Personal Computer Memory Card International Association) card, a Firewire connection, or any other mechanism that permits the coupling of the portable PEPS to a computer system. In one embodiment, PEPS may be implemented in software using a Java applet, ActiveX, Web application or similar technology.

FIG. **1**A is a block diagram of a network including a computer system on which the PEPS may be used. There are five layers of protection, around Host B **100**, the computer into which the PEPS has been inserted.

First the checking for potential spyware takes place (**110**). After successful check—i.e. no spyware found or spyware removed—the PEPS is authenticated, enabling its use. The user can then select a secured application from the PEPS. Secured applications include, in one embodiment, files in the Vault (secure storage), Browser and Email clients, and other applications available from the PEPS. In one embodiment, any application used with the PEPS can be a secure/stealth application. Secure applications are applications that are uploaded from the PEPS, and are therefore controlled. Stealth applications are applications residing on the PEPS or on the insecure computing system, whose outputs are all redirected to the Secure Cache, including temporary files, so that they leave no traces on the computer. The secure cache can reside on the PEPS or be created on the insecure system under control by the PEPS and will, in the latter case, be securely deleted after the PEPS has been unplugged.

The system further includes an application level firewall (**120**) that protects communication.

A privacy and stealth system (**130**) controls cookies, harmful code, and will not leave any trace behind on the computer that has been used. The system ensures that not even temp files are left behind after use. The system can even use the computers own browser for full functionality. The browser is used securely by redirecting anything that leaves traces, such as temp files, temp Internet files, cookies etc to the PEPS. Secure communication (**140**) comes from using the tech-

niques above in for the Browser in combination with SSL to communicate back to the organization. Secure data (**150**) is the data that is stored in the Vault on the PEPS.

FIG. **1**B illustrates the interaction between the PEPS and the surround security server. The surround security server may be a central server, or may be a server provided by a corporation for its employees. The PEPS connects to the surround security server, and downloads configuration files and signature updates. In one embodiment, the PEPS may also upload log data to the server. This process is described in more detail below with respect to FIG. **11**. The process starts when the PEPS wishes to connect to the server for an update. In one embodiment, the PEPS is periodically triggered to connect to the server, if a secure connection is available. In another embodiment, every time the opportunity presents itself, the PEPS connects to the server.

At block **1120**, a secure connection is established with the server. In one embodiment, the secure connection is established once the PEPS security is installed, as described below. If Level-1 or Level-2 security is established, and secure shell (SSH), secure sockets layer (SSL), or another secure connectivity method is available, the PEPS can establish a secure connection with the server.

At block **1130**, the PEPS check for, and downloads any updates for applications, and malicious software signatures. In one embodiment, a CRC, version number, or similar identifier is used to determine whether the PEPS has the most current information. If it does not, the PEPS downloads the new data from the server.

At block **1140**, the PEPS checks for and download a new configuration file, if available.

At block **1150**, the PEPS applies the changes and updates. In on embodiment, the PEPS immediately authorizes and implements new policies through connecting to the server and downloading the new policy right after the PEPS is connected to a computer. In one embodiment, this update occurs every time the PEPS is securely connected to a computer system. In one embodiment, in addition to updating its internal settings, the PEPS verifies its current connection using the new data. That is, for example, if an additional malicious software signature was added, the PEPS starts checking for the new signature immediately upon successfully downloading the updated signature file.

At block **1160**, the PEPS uploads log and status files. In one embodiment, the PEPS logs the instances of malicious software disabled and connections prohibited, as well as anything else of relevance to blocking. In one embodiment, this data is available to the user, from the server's web site. In another embodiment, the web site collects this data without any user identifying information. In another embodiment, the user may turn off logging.

In one embodiment, the PEPS is centrally managed by an enterprise or the like. For example, a corporation may provide PEPS to its employees, and also provide the server that updates the PEPS and collects log data. In one embodiment, the administrator can review logs and get alarms about Spyware etc. In one embodiment, the administrator may be able to shut down the users SSL connection to the company remotely. Thus, while the system provides security and stealth against outsiders, the administrators of the enterprise system would have access to the logs and other files on the PEPS. In one embodiment, the logs may include, for example, sites visited, etc.

FIG. **2** is a block diagram of the software components of the PEPS **200**. In one embodiment, the system has three levels of security which may be invoked. Level 3 permits the user to use the applications available on the system securely, without leaving a trace on the host computer. Level 3 security may be used to keep your privacy on the host computer. In one embodiment, Level 3 security may also include scanning for keyboard loggers and Spyware, getting secure email, using the web and SSL VPN to connect back to the enterprise, etc. All of these features are available without leaving any traces on the host computer. Level 3 security may be used when there is no chance of installing anything on the computer due to limited rights, whether it is a company computer or not. In general, Level 3 security provides no chance of monitoring the user. However, if the PEPS system belongs to an enterprise (or there is an administrator other than the user), the enterprise can obtain traces and data from the logs on the PEPS.

Level 3 provides customized applications, from the PEPS to provide security. However, Level 3 can be implemented without admin rights on the computer system.

Level 2 security provides application control, as well as content filtering and content control mode, using the existing applications on the computer system. Level 2 security, in one embodiment, provides a better filter for the communication, and ensures that any malicious applications and harmful embedded code such as Spyware and ActiveX components are nullified. Level 2 security may further as enforce content filtering and content control such as modifying the cookies (for increased privacy).

Level 2 security provides more extensive filtering of the communication and stops potential Spyware from communicating. Communication requests can be matched to the applications that are authorized to communicate. Content filtering can also be enforced on the browser. In one embodiment, cookie control may modify the content of the cookies for increased privacy. Level 2 security can, in one embodiment, block harmful code, and block advertising as well.

In one embodiment, the memory subsystem **205** on PEPS is split into two primary regions, System Vault **210** and Data Vault **215**. This allows the PEPS to handle security of information in a methodical manner.

The system vault **210** is a hidden, non-user-writeable area of memory where the PEPS applications are stored. In one embodiment, a security application **222** is stored along with enforcement data **220** such as configuration file and user credentials. In one embodiment, the PEPS application includes elements in formats such as Java applet, application or a windows DLL. An XML configuration file **225**, which carries the corporate policies regarding usage and communication, is stored in the system vault **210** as well. User credentials **230** such as password for installation, password for accessing the Data Vault, password or digital certificate for establishing credentials to a corporate back-end, are stored in the system vault **210** as well. The system vault **210** is for system use only, and requires a manager application to modify or add data.

The data vault **215** is where user specific data is stored. In one embodiment, access to the data vault **215** requires secure password-based authentication. However, in one embodiment, the user can view the listing of files and directories in the data vault **215** once the user is initially authenticated for PEPS installation. In one embodiment, the user would be granted a limited number of attempts to provide the correct password. For example, the number of attempts may be set at three. In one embodiment, the number of attempts permitted may be altered by an administrative user, as will be described below.

After, the number of failures, the system locks out the user. Once the Vault **215** is in this state, in one embodiment, the system uses a data recovery key to access the Vault. The data

recovery key, in one embodiment, requires administrative access to reset the Data Vault **215** password. In one embodiment, no one can penetrate the vault once it is locked, without the data recovery key. This provides security in case the PEPS is lost and recovered by a non-trusted third party. In one embodiment, secure remote help may be provided to reset the user password. The PEPS could also be used, in one embodiment, as part of the authentication system to authenticate the user to Windows, at Level-1. In one embodiment, the PEPS could replace a smart card for authentication purposes. In one embodiment, the hooks in Windows to provide third party authentication may be used to provide this service.

FIG. **3**A is a flowchart of one embodiment of using the PEPS system. The process starts at block **305**. At block **310**, the PEPS application is launched. In one embodiment, this occurs automatically when the PEPS is coupled to the computer system. The PEPS may be coupled to the computer system physically via USB, Firewire, USB 2.0, PCMCIA, or similar connection. Alternatively, infrared, Bluetooth, wireless, or other connectivity may be used. In one embodiment, the PEPS system is coupled directly to the computer system.

At block **312**, the scan for spyware is performed. In one embodiment, this scan is repeated periodically. For example, the spyware scan may be repeated every 30 seconds. The spyware scan is shown in more detail in FIGS. **4** and **5**.

At block **314**, the process requests user authentication. In one embodiment, authentication requests a user ID and password. Alternately, the authentication may request a password only. Alternative means of authentication, known in the art, may be used.

At block **316**, the process determines if the authentication was successful. If the authentication is successful, the process continues to block **330**. Otherwise, the process continues to block **318**, to determine whether there have been three unsuccessful attempts at authentication. In one embodiment, the user gets three opportunities to correctly authenticate to the PEPS. In one embodiment, the user, when setting up the PEPS, can set a number of tries available. In another embodiment, another number of tries may be set by the system.

If the number of tries available have not been used, the process returns to block **314**, to again request user authentication information.

If the number of retries has been exhausted, the process continues to block **320**.

At block **320**, the PEPS is locked. In one embodiment, the PEPS can subsequently be unlocked by someone with administrative rights, on a secured computer system. In another embodiment, secure Remote Help provided by the administrator may be used to unlock the PEPS, or reset the users password. In one embodiment, only a preset number of remote unlock attempts are permitted. At block **322**, the PEPS autorun is locked. The autorun is the automatic launch enabler, which automatically launches the PEPS application when the PEPS is coupled to a computing system. At block **324**, the portions of the PEPS applications that were added to the computer system are unloaded, to leave a pristine computer system, without any evidence of the PEPS. The process then ends at block **326**.

If, at block **316**, the user was successfully authenticated, the process continued to block **330**. At block **330**, the process determines whether the computer system has a surround security application installed. In one embodiment, the system determines whether the Fireball Surround Security Application™ manufactured by RedCannon, the assignee of the present application, is installed. A description of a system that may be the underlying security application on the computer system is described in co-pending application U.S. Ser. No. 10/739,552, filed Dec. 17, 2003, entitled "A Method And Apparatus To Secure A Computing Environment", assigned to the assignee of the present application. That application is incorporated herein by reference. In another embodiment, the process determines whether an operating system is installed that enables full surround security installation from the PEPS. If so, the process continues to block **332**, as if the Fireball Surround Security Application™ were installed on the system.

If the surround security application is installed, the process continues to block **332**. This, described as Level-1, provides the highest level of protection and functionality for the user. Since the surround security system is enabled, the user can be sure that the computer system is secure and fully functional.

At block **332**, the functions of the PEPS are disabled, except for the Vault. The security applications that would be provided by PEPS are instead run on the underlying surround security system. At block **334**, the surround security manager application is notified that the PEPS has been plugged in.

At block **336**, the vault explorer is launched. The vault explorer is described in more detail in FIG. **6**, below. The user is then able to use the system.

The system continues to monitor, to determine whether the user has unplugged the PEPS, block **338**. If so, the process continues to the unloading stage. The unloading process is described in FIG. **9**, below.

The system furthermore continues to monitor for user commands, block **340**. If a user command is issued, the process continues to block **341**. At block **341**, the process executes the command/action. These actions may include encryption/decryption of files, opening files, etc. The process then returns to block **338**, to monitor whether the user has unplugged the PEPS.

If, at block **330**, the process did not find the surround security system installed, the process continues to block **342**.

At block **342**, the process determines whether the user has administrative rights on the computer system. Administrative rights enable the user to install applications on the computer. If administrative rights are available, the process continues to block **344**. This level of security is designated Level-2, indicating an intermediate level of security. All of the security features available with Level-1 are installed, except the network layer firewall and intrusion detection system, since these require a reboot and most of the time that is not an option available on public computers. In another embodiment, if the operating system permits Level-1 security even without the preinstalled system, the Level-2 security may be selected because of user preference or speed considerations.

At block **344**, the PEPS Enforce DLL is installed.

At block **346**, the application firewall is initialized. At block **348**, the cookie control and content filter is initialized. At block **350**, the harmful code filter is initialized. At block **352**, the enforcement mechanism is installed. In one embodiment, the enforcement mechanism is a dynamically linked library (DLL). These methods are described in more detail in co-pending application Ser. No. 10/739,552, incorporated by reference.

The process then continues to block **336**, and the vault explorer is launched.

If, at block **342**, the process determined that no administrative rights were available—i.e. the system is not permitted to install applications onto the computer system—the process continues to block **354**. This level of security is referred to as Level 3, when the process has very limited user rights. Secured versions of the applications that are most common are made available from the PEPS.

At block **354**, the GUI functions the various applications available from the PEPS are enabled. In one embodiment, the system adds icons for the available secure applications to the desktop. At block **356**, the user selects an application.

If the user selects the email client, at block **358**, the secure email client is initialized. At block **360**, the email filtering application is enabled. This provides a secure email client, including spam and virus filtering. The process then continues to block **336**, where the vault explorer is initialized.

If the user selects the web browser, a secure web browser is initialized at block **362**. At block **364**, the cookie control and content filter are initialized. The cookie control ensures that all cookies are stored on the PEPS, and that no tracking cookies are enabled.

At block **366**, the temp files are redirected to the PEPS, so that no temp files are stored on the system. In another embodiment, temp files for history and cache may be disabled. The process then continues to block **336**, where the vault explorer is initialized.

FIG. **4** is a flowchart of one embodiment of the spyware scanning engine. The process starts at block **405**. In one embodiment, the process corresponds to block **312** of FIG. **3**.

At block **410**, the spyware, network, keyboard logger, and adware scanner are initialized. The spyware, network, keyboard logger, and adware data is contained, in one embodiment in a database on the PEPS. In another embodiment, the database may be located on a remote server, accessed by the PEPS.

At block **415**, the process determines whether there is a signature match between the spyware being tested and applications on the computer system. In one embodiment, the signature match tests the hard disk and registry entries. If there is a signature match, the process continues to block **420**. At block **420**, the user is warned with details and help. If the user does not wish to continue, the process continues to block **435**, cleans up and unloads the PEPS, and terminates.

If the user wishes to continue (i.e. use the system in spite of this), the process continues to block **430**. At block **430**, the process configures the firewall to block the spyware application from communicating its data. In one embodiment, the process also blocks the spyware application from logging (i.e. temporarily storing) its data. In one embodiment, the process also blocks the spyware application from launching (blocking the application from even starting if it is coming into the system while PEPS system is protecting the system).

The process then continues to block **440**, where it tests whether all entries in the list of spyware have been tested against. If not, the process returns to block **415**, to test the next spyware signature. If all of the entries have been tested, the process continues to block **445**.

At block **445**, the process determines whether a signature in the keyboard logger, network, or adware listings is matched. In one embodiment, the match is with RAM data or processes on the computer system. If a match is found, the process continues to block **450**, to configure the firewall to block the application from communicating. In one embodiment, the system further blocks these applications from storing their data. The process then continues to block **455**, to determine whether all entries in the list of network, keyboard loggers, and adware have been tested. If not, the process returns to block **445**, to test the next item's signature. If all of the applications have been successfully scanned, the process continues to block **460**.

At block **460**, process scanning is performed. This is described in more detail below with respect to FIG. **5**.

At block **465**, a secure cache area is created in the RAM and disk, and memory is initialized. The secure cache area is a designated area on the disk which will be used by the PEPS and related applications. This secure cache area will then be purged when the PEPS is removed.

At block **470**, the temporary storage for the operating system and applications is redirected to the secure cache area.

At block **475**, the process scanner module is initialized. This is described in more detail below.

At block **480**, the configuration settings for the browser are reviewed. In one embodiment, if the secure browser provided by the PEPS is used, this set of steps may be skipped, and the process may continue directly to block **480**, and end.

At block **485**, the browser settings are modified/hardened. In one embodiment, the registry settings associated with the browser are modified/hardened. At block **490**, the process stops.

FIG. **5** is a flowchart of one embodiment of the process-scanning portion of the spyware scanning engine. The process starts at block **505**. At block **510**, a memory table is created for the process list.

At block **515**; a process list of currently running processes and their matching resources is created. In one embodiment, the names of the executables, DLLs, and other running threads, and their associations is put into the process list.

At block **520**, the process tests the first entry in the process list, to see whether the process matches any harmful spyware or data logger signature. In one embodiment, the comparison signatures are in the PEPS. In one embodiment, the PEPS is periodically updated with new signatures, when the PEPS is inserted into a secure computer. In another embodiment, the signatures are on a remote server, and are obtained by the system through a VPN (including SSL VPN) or similar connection. Such secure connections are known in the art. If the signatures do not match the currently tested process, the system continues to block **525**, to determine whether all of the processes in the process list have been tested. If not, the system returns to block **520**, to test the next process. If all of the processes have been tested, the system continues to block **540**.

If, at block **520**, the process was found to match a signature, at block **530**, the user is warned. In one embodiment, the warning includes the identity of the harmful application, its risks, etc. The system then queries the user, whether he or she wishes to continue, at block **535**. If the user wishes to continue, the system returns to block **520**, to test for other matches. In one embodiment, the system attempts to block the harmful spyware/logger/network monitor/etc. If the user does not wish to continue, the system terminates, and unloads the PEPS. The unloading process is described in FIG. **9**, below.

If, the system finishes checking all of the processes, at block **525**, it determines, at block **540**, whether the preset time period has elapsed. The preset time period is the time which the system waits before re-executing the process scanning. In one embodiment, the preset time period may be 30 seconds. Alternatively, the user may set the preset time period. In another embodiment, the process scanner may be triggered whenever a new process is activated.

If the time period has expired, the system returns to block **510**, to restart the scan. Otherwise, the system continues to block **545**. At block **545**, the system determines whether an unload has been issued. If no unload has been issued—i.e. the PEPS has not been removed from the computer—the system returns to block **540**. If an unload has been issued, the system continues to block **550**.

At block **550**, the system deletes the process table, and at block **560**, the system de-allocates the memory. The process scanner then stops, at block **565**.

FIG. **6** is a flowchart of one embodiment of installing the vault on the PEPS. This process corresponds to block **336**, of FIG. **3**.

At block **620**, a temporary memory is initialized for Vault data. In one embodiment, the temporary memory initialization allocates the memory, and restricts memory access through the PEPS. This ensures that only the PEPS validated applications can access the memory. The memory, in one embodiment, is located on the hard drive of the system. In another embodiment, the memory may be located on the PEPS.

At block **630**, the process launches the vault explorer. At block **640**, the vault DLL is launched. This enables the vault. The process then waits for a user command, at block **650**.

FIG. **7** is a flowchart of one embodiment of outbound data communication processing. The process, at block **710**, determines whether the firewall rules allow the communication. The firewall rules specify which types of communication are acceptable. If the firewall rules do not permit the communication, the process continues to block **720**. At block **720**, the packets are dropped, the connection is closed (block **730**), and the attempt is logged in the secure cache (block **740**). In one embodiment, the data in the secure cache is uploaded to the server, once the PEPS is coupled to a secure computer. This data is then used, in one embodiment, to update the list of spyware, logging, and other dangerous applications.

If the firewall permits the communication, at block **710**, the process continues to block **750**. At block **750**, the process determines whether the content filter permits the communication. In one embodiment, a content filter may filter objectionable communication. If the content filter indicates that the communication should be prohibited, the process continues to block **720**, to drop the packets, close the connection, and log the communications attempt.

If the content filter permits the communication, the process continues to block **760**.

At block **760**, the process determines whether the communication is to the enterprise secure site. If it is not, the process continues to block **770**, and the data is passed to the Winsock.

If the communication is to the enterprise secure site, the process continues to block **780**. At block **780**, the comm credentials are initialized. At block **790**, secure SSL communication is initialized. The data is then passed to the Winsock, at block **770**. This ensures that only screened communications are permitted.

FIG. **8** is a flowchart of one embodiment of inbound data communication processing. The process starts when an inbound data packet is received.

At block **810**, the process determines whether the data is a session start request. If so, the process continues to block **820**, and the packet is dropped. The connection is then closed, at block **830**. The process then ends at block **895**. The present process, for security reasons, will not permit session start requests from external agents. Rather, the user's system has to request the session start.

If the packet was not a session start request, at block **810**, the process continues to block **840**. At block **840**, the process determines whether the data is a reply to a data packet from the user. If it is not a reply, the process continues to block **820**, and drops the packet, closes the connection, and ends. The present process, for security reasons, will not permit any communication that was not initiated by the user.

If the packet was a reply, at block **840**, the process continues to block **850**.

At block **850**, the process determines whether data matches a harmful code signature. Harmful code signature indicates that the data being sent is a virus, a harmful application, or not permitted for another reason. If the data matches a harmful code signature, the process continues to block **820**, to drop the packet, close the connection, and end.

If the packet does not match any harmful code signatures, the process continues to block **860**.

At block **860**, the process determines whether the packet is a cookie, or cookie component. If so, the data is stored in the secure cache, at block **870**, described above. The process then ends at block **895**.

If the packet is not a cookie, the process continues to block **880**. At block **880**, the process the process determines whether the packet is part of a temporary download. If so, it is stored in the secure cache, at block **870**.

If the packet is not a temporary download, the data is passed to the applicant at block **890**. The process then ends at block **895**.

FIG. **9** is a flowchart of one embodiment of the unload process. The process starts when the user presses "unload" or removes the PEPS.

At block **910**, the process determines whether the unload was triggered by the user pressing unload. If so, the PEPS is still connected to the computing system. The process therefore continues to block **915**. At block **915**, the system prompts for data synchronization to the vault. The data synchronization moves any newly created data on the computer to the PEPS system memory. The process then continues to block **920**. If the user did not press unload, and the PEPS was removed, the process continues directly to block **920**.

At block **920**, all of the data in the secure cache is deleted.

At block **925**, the swap file and history files created during the use of the system are cleaned up. In one embodiment, instead of simply removing the file name, as standard deletion does, the deletion overwrites the data with new data, to ensure that it cannot be recovered.

At block **930**, the vault DLL is unloaded.

At block **935**, the process scanning is stopped.

At block **940**, the DLL associated with the enforcement of the firewall rules and information secure are unloaded.

At block **945**, the system memory that was used is deallocated. This frees up the memory that was previously used for the cache, as well as any applications that were running from the PEPS.

At block **950**, the browser settings are restored. In one embodiment, when browser settings are altered during installation, the original browser settings are saved in a "prior state" file. This is used to restore the browser to its previous state.

At block **955**, the Enforce DLL is uninstalled, and any secure applications that were running on the system are uninstalled. The process then ends at block **960**.

FIGS. **10**A-C are block diagrams illustrating where the protection takes place in the OS and communication stack. FIG. **10**A illustrates the Level-1 protection, which is available if the surround security is preinstalled on the computer system.

The portions of the computer system that are unchanged include the Winsock DLL, OS interface, OS flash driver, TCP/IP stack, Winsock driver, and network interface. At Level-1, shown in FIG. **10**A, the Internet applications include the surround security Enforce DLL. The PEPS applications, and associated DLLs are also resident on the computer system. The Vault also has a DLL associated with it. The PEPS itself, of course, is coupled to the computer system. The network driver interface specification (NDIS) includes a network firewall, an intrusion detection system, and a VPN connection. Note that these elements are part of the surround

security system, not of the PEPS. The elements added by the PEPS are the applications and associated DLLs, and the vault and associated DLL.

In comparison, FIG. **10**B illustrates the computer system at Level-2, a computer system with no pre-installed elements, but with administrative access. As can be seen, the system is similar to that of FIG. **10**A. However, the NDIS does not include any elements. Also, note that the LFE is from the PEPS, since there is no preinstalled surround security to take advantage of.

Compare this with Level-3 security, shown in FIG. **10**C. This is available for systems that do not provide preinstalled surround security, and do not provide administrative access.

The system includes PEPS secured applications, described above, as well as the associated DLL, and Vault DLL. The system further includes a PEPS filtering layer, which replaces the LFE.

In the foregoing specification, the invention has been described with reference to specific exemplary embodiments thereof. It will, however, be evident that various modifications and changes may be made thereto without departing from the broader spirit and scope of the invention as set forth in the appended claims. The specification and drawings are, accordingly, to be regarded in an illustrative rather than a restrictive sense.

What is claimed is:

1. A portable end-point security (PEPS) system designed to be plugged into a computing system, comprising:

a PEPS processor having a memory operatively coupled thereto, the memory having stored therein instructions which when executed by the PEPS processor causes:

an automatic loader to automatically trigger loading of the PEPS system when the PEPS system is being plugged into the computing system, the loading performed in cooperation with a primary operating system installed on the computing system;

the PEPS system including a malicious software detector to scan a main memory of the computing system for malicious software;

wherein the malicious software detector performs a scan of the main memory of the computing system following triggering of the PEPS system by the automatic loader by comparing existing data in main memory of the computing system with indicia of malicious software, wherein said scan performed by the malicious software detector includes the malicious software detector checking processes that are currently running on the computing system during said scan;

wherein the instructions which when executed by the PEPS processor causes a detector to determine what level of security should be installed on the computing system;

wherein the level of security depends on a presence of a security system already installed on the computing system and administrative privileges available on the computing system;

wherein the security system permits the computer system to be secure; and

wherein the PEPS system is plugged into the computing system via a computing system interface.

2. The PEPS system of claim **1**, further comprising instructions which when executed by the PEPS processor causes:

a cache creator to create a secure cache to store all temporary files created during the use of the computing system;

wherein the secure cache stores: cookies, persistent cookies, downloaded data, and email.

3. The PEPS system of claim **1**, further comprising:

signature files for indicia of malicious software; and

the malicious software detector to compare processes and applications on the computing system with the signature files.

4. The PEPS system of claim **1**, wherein the malicious software detector is run upon initialization of the PEPS system.

5. The PEPS system of claim **1**, wherein the malicious software comprises one or more of the following: spyware, key logger, process logger, network logger, viruses, and adware.

6. The PEPS system of claim **1**, further comprising instructions which when executed by the PEPS processor causes:

an application firewall to screen communications between the computing system and a network.

7. The PEPS system of claim **6**, wherein the application firewall is further to ensure that malicious software cannot be used to communicate user data.

8. The PEPS system of claim **1**, further comprising instructions which when executed by the PEPS processor causes:

an application blocker to prevent launching of malicious software applications, once the PEPS system is active.

9. The PEPS system of claim **1**, further comprising instructions which when executed by the PEPS processor causes:

a data vault to be generated within the PEPS system;

the data vault to store data securely;

wherein the data vault is accessible only to an authenticated user.

10. The PEPS system of claim **1** further comprising instructions which when executed by the PEPS processor causes:

the PEPS system to perform user authentication with the computing system or a server;

wherein the user authentication comprises one or more of the following: a password, a smart card, a challenge/response token and a biometric authentication.

11. The PEPS system of claim **1**, further comprising instructions which when executed by the PEPS processor causes:

using the PEPS system for authentication within a Windows Operating System.

12. The PEPS system of claim **1**, further comprising instructions which when executed by the PEPS processor causes:

secure applications to run from the PEPS system.

13. The PEPS system of claim **1**, further comprising instructions which when executed by the PEPS processor causes:

an uninstall function to automatically remove traces of the PEPS system from the computing system, when the user discontinues use of the computing system.

14. The PEPS system of claim **13**, wherein the uninstall function is triggered by the removal of the PEPS system from the computing system.

15. The PEPS system of claim **1**, further comprising instructions which when executed by the PEPS processor causes:

a communicator to communicate with a server to update the PEPS system.

16. The PEPS system of claim **15**, wherein the PEPS system downloads one or more of the following: policy, product updates, vault recovery data, and malicious software signature updates.

17. The PEPS system of claim **1** wherein the PEPS processor operates with the computing system.

18. A computer program product embodied in a portable end-point security (PEPS) device comprising instructions which when executed by a PEPS processor causes the PEPS processor to:

automatically trigger the PEPS device to load a PEPS system into a main memory of a computing system when the PEPS device is plugged into the computing system, the PEPS system including an operatively loaded malicious software detector, the loading performed by an automatic loader in cooperation with a primary operating system installed on the computing system;

cause the main memory of the computing system to be scanned for malicious software with the operatively loaded malicious software detector;

wherein the malicious software detector performs a scan of the main memory of the computing system following triggering of the PEPS system by the automatic loader by comparing existing data in main memory of the computing system with indicia of malicious software, wherein said scan performed by the malicious software detector includes the malicious software detector checking processes that are currently running on the computing system during said scan;

wherein said instructions which when executed by the PEPS processor causes a detector to determine what level of security should be installed on the computing system;

wherein the level of security depends on a presence of a security system already installed on the computing system and administrative privileges available on the computing system;

wherein the security system permits the computer system to be secure; and

wherein the PEPS system is plugged into the computing system via a computing system interface.

19. The computer program product of claim 18 further comprising instructions which when executed by the PEPS processor causes the PEPS processor to:

operatively load an application blocker into the main memory of the computing system;

cause the computing system to prevent any malicious software applications identified by the malicious software detector from launching with the application blocker.

20. The computer program product of claim 18 further comprising instructions which when executed by the PEPS processor causes the PEPS processor to:

operatively load a cache creator into the main memory of the computing system;

cause the computing system to create a secure cache with the cache creator to store all temporary files created during the use of the computing system.

21. The computer program product of claim 18 further comprising instructions which when executed by the PEPS processor causes the PEPS processor to:

operatively load an application firewall into the main memory of the computing system;

cause the computing system to screen communications between the computing system and a network with the application firewall.

22. The computer program product of claim 21 wherein the application firewall ensures that malicious software cannot be used to communicate user data.

23. The computer program product of claim 18 further comprising instructions which when executed by the PEPS processor causes the PEPS processor to:

perform user authentication with the computing system or a server;

wherein the user authentication comprises one or more of the following: a password, a smart card, a challenge/response token and a biometric authentication.

24. The computer program product of claim 18 wherein the PEPS processor operates with the computing system.

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